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(54) Title: A DATA STORAGE AND REDUCTION METHOD FOR DIGITAL IMAGES, AND A SURVEILLANCE SYSTEM USING SAID METHOD

(57) Abstract

A data storage and reduction method for digital images having a chronological order involves storing a first and chronologically new image or group of images at a first image quality requiring a first amount of storage space, and processing a second image or group of images, chronologically older than said first image or group of images, by reducing the image quality thereof to a second image quality requiring a second amount of storage space, which is less than said first amount of storage space. Advantageously, the method is used for a surveillance system, comprising a camera, a digital storage device and an image storage controller, wherein image quality is reduced for old or otherwise less important images or groups of images, thereby obtaining additional storage space for allowing more important images (such as images relating to an alarm event) to be stored at higher image quality, while retaining an extended total recording time span.

A DATA STORAGE AND REDUCTION METHOD FOR DIGITAL IMAGES, AND
A SURVEILLANCE SYSTEM USING SAID METHOD

Technical Field

The present invention generally relates to a data storage and reduction method for digital images having a chronological order. More particularly, the present invention relates to a surveillance system using such a method and having a camera, a digital storage device and an image storage controller operatively connected to the camera and the storage device for receiving a plurality of images from the camera and storing the images digitally in the storage device, the images having a chronological order reflecting the points of time, at which the images were produced. The invention also relates to a method of storing such digital images.

Background Art

Surveillance camera systems are commonly used for monitoring various areas in place of business, such as cashier windows at a bank or gambling tables at a casino. Traditionally, such surveillance systems have included analog video cameras, which continuously record all activities within a surveillance zone on a magnetic tape cassette, such as a standard VHS cassette. Typically, such cassettes have a nominal recording time of a few hours, e.g. 2, 4 or 8 hours. When the tape cassette has been fully recorded, the cassette will have to be substituted by an empty one by a human operator.

The maximum recording time may be increased by reducing the speed, at which the magnetic tape is moved in relation to the recording head, thereby reducing the number of frames stored per second. In this way the maximum recording time for a standard VHS tape may be extended to e.g. 48 hours, thereby obviously also extending the time

between cassette substitution correspondingly. However, the penalty for not having to switch tapes as frequently is a substantial reduction in image quality for the entire recording time.

5   In recent years, digital video cameras have entered the market. Such cameras produce a sequence of digital snapshot images or still images at a constant rate. For instance, European-type cameras produce images at a rate of 25 images or frames per second (fps), while US-type cameras

10   operate at 30 fps. When the sequence of images is played back, the rapid switch between images is transparent to a human observer. Instead, the sequence of snapshot images is experienced as a continuous stream of moving images.

The output of digital cameras is stored on an appro-

15   priate storage medium, such as a magnetic disk (hard disk), an optical disk (CD, DVD) or a digital magnetic tape (DAT). Similarly, the output of analog cameras may be digitised into a sequence of digital images to be stored on such a storage medium.

20   The images are usually compressed by way of a data compression algorithm, such as JPEG, MPEG, wavelet or fractal compression, wherein certain image information is eliminated and the amount of storage space is reduced accordingly. Since each digital image anyway requires a

25   substantial amount of storage space (typically 10 to 1000 KB), even if a high-density, state-of-the-art digital storage medium is employed, all available storage space will eventually be consumed by the sequence of images produced by the camera. In such a situation, one option is to manu-

30   ally switch to another digital storage medium with free storage space, for instance by having an operator exchange a magnetic disk, an optical disk or a digital tape cassette.

However, being dependent of a human operator for

35   regularly providing additional storage space is undesired

in many applications, particularly in applications where
the surveillance system is to be used during non-office
hours, for instance during evenings or nights.

An obvious way of automatically handling situations,
where the currently used storage medium have become com-
pletely or almost completely filled with digital images, is
to sacrifice the oldest images on a first-in-first-out
(FIFO) basis, so that the storage space occupied by such
old images are continuously reused for storing new images.

However, this approach has at least two drawbacks,
the first of which being the limited preservation of hi-
storic image information. Every storage medium has a maxi-
mum amount of storage space available for storing digital
information. Irrespective of the actual value of the maxi-
mum amount of storage space, each storage medium will only
be able to store a certain number of images, this number
being dependent of the maximum storage capacity of the
storage medium, the pixel resolution of each image, and the
frequency or rate (fps) of these images. For instance, if a
particular storage medium is only capable of storing a se-
quence of images corresponding to e.g. two hours of recor-
ding time, then all events that have occurred more than two
hours ago will be completely and irrevocably lost, when
such an automatic procedure for reusing storage space is
employed.

A second drawback is that such an automatic FIFO pro-
cedure inherently operates under the assumption that the
oldest image information is always the least important.
However, in many situations certain older image information
may actually be of higher importance than certain younger
image information, for instance if an alarm situation has
occurred and has been incorporated in such older image in-
formation.

Summary of the Invention

It is an object of the present invention to provide a substantial improvement to camera-based surveillance systems. In particular, an object of the invention is to chronologically extend the scope of image information recorded and stored by a surveillance camera system, so that chronologically old image information may be kept for a longer period of time than with the prior art systems.

A further object is to provide enhanced representation of images related to a historic alarm event. Yet another object is to provide an option for a user of the system to dynamically define the chronological image information coverage provided by the system.

Generally, the objects above are achieved by storing new digital images at a high image quality and provide time-dependent reduction in image quality for certain older images or groups of images, thereby reducing the storage space required for such certain images.

More particularly, the main objects of the invention are achieved by a data storage and reduction method for digital images having a chronological order, wherein a first and chronologically new image or group of images is/are stored at a first image quality requiring a first amount of storage space, and wherein a second image or group of images, chronologically older than said first image or group of images, is processed by reducing the image quality thereof to a second image quality requiring a second amount of storage space, which is less than said first amount of storage space.

The main objects of the present invention are also achieved for a surveillance system comprising a camera, a digital storage device and an image storage controller operatively connected to the camera and the storage device for receiving a plurality of images from the camera and storing the images digitally in the storage device, the images

having a chronological order reflecting the points of time,
at which the images were produced, by providing the image
storage controller with: first means for determining a
qualitative value for individual images, or groups of
images, stored in the storage device, the qualitative value
being a function of a chronological position of the respec-
tive image or group of images; second means for selecting,
among the images stored in the storage device, a particular
image or group of images in response to its qualitative
value; and third means for compressing or deleting said
particular image or group of images.

Other objects, advantages and features of the present
invention will be apparent when studying the following de-
tailed disclosure, the appended claims as well as the
attached drawings.

Brief Description of the Drawings

The invention will be described in more detail in the
following, reference being made to the accompanying draw-
ings, in which:

FIG. 1 is a schematic block diagram illustrating a
surveillance system according to a preferred embodiment,

FIG. 2a is a schematic flow diagram of the main steps
of a method according to the invention,

FIG. 2b illustrates an alternative to the flow dia-
gram of FIG. 2a,

FIG. 3 is a block diagram illustrating the main com-
ponents of the preferred embodiment of the surveillance
system,

FIGS. 4, 5a-5e and 6a-6e are graphical illustrations
of different momentary image storage schedules.

Detailed Disclosure

FIG. 1 is an overall view of a surveillance system
according to a preferred embodiment of the invention. A

camera 30 is arranged to monitor a surveillance zone 10,
which may be any given volume or area, which for some rea-
son it is desired to monitor. Hence, the surveillance zone
may be a selected part of a bank, a post office, a casino,
a factory, office premises, a prison, a criminal custody or
detention room, a police station, a house garden, a garage
or any other area of surveillance. For the following dis-
closure the camera 30 is assumed to be a digital video ca-
mera, i.e. a camera which is arranged to provide a sequence
of snapshot or still images at a predetermined rate, such
as 25 fps. However, the camera 30 may equally well be a
conventional analog camera, providing analog video output,
which is converted into digital images by a commercially
available image digitiser. The camera 30 is connected to an
image storage controller 40, which may be implemented by
any commercially available computer, such as a PC-compa-
tible computer, or a stand-alone device comprising hardware
and software logic for providing the functionality de-
scribed in more detail below. Alternatively, the image
storage controller may be implemented by electronic cir-
cuitry inside the camera 30.

      The image storage controller 40 is operatively con-
nected to a random access storage device 50, such as a hard
disk or other digital storage media. The system may also
comprise an alarm detector 20, which is operatively con-
nected to the image storage controller 40 and is arranged
to detect an abnormal situation occurring within or outside
the surveillance zone 10. The alarm detector 20, which will
be described in more detail below, may for instance be a
commercially available infrared movement detector, smoke
detector, humidity detector, magnetic door- or window-
mounted sensor, acoustical sensor, laser detector, manually
operated alarm button, etc.

      FIG. 2a illustrates the overall operating principle
of the surveillance system shown in FIG. 1. The camera 30

is arranged, as previously mentioned, to produce a conti-
nuous sequence of digital images, representing snap shots
of the momentary situation within the surveillance zone 10
at regularly distributed moments of time. Preferably, the
5   camera 30 produces images at a constant rate, such as 25
fps (frames or images per second). The images produced by
the camera 30 are sequentially supplied to the image stor-
age controller 40, which receives each new image at a step
100.

10   In a step 110 the image storage controller 40 deter-
mines whether there is currently enough storage space
available in the storage device 50. If the answer is in the
affirmative, control is transferred to a step 120, wherein
the new image is forwarded to the storage device 50 and
15   stored therein. If, on the other hand, it has been deter-
mined, in step 110, that there is not enough storage space
available, then control is transferred to a step 130. Step
130, which represents a key element of the present inven-
tion, will be thoroughly described in the following sec-
20   tions. In summary, the task of step 130 is to evaluate the
importance of individual images or groups of images already
stored in the storage device 50, select one or more than
one of these images to be "sacrificed" and then either re-
duce the quality of the image(s) or completely eliminate
25   it/them. The purpose is to release some storage space,
which is large enough for storing a new image received at
step 100. After having released the storage space, control
is returned to step 110 for checking whether the storage
space thus released is enough for storing the new image,
30   i.e. whether there is now enough storage space available in
the storage device 50.

         As an alternative to the overall operating principle
of FIG. 2a, the operation may be divided into two separate
processes, as shown in FIG. 2b. The first process is an
35   endless loop, where new images are received in a step 200

and stored in the storage device in a step 220. Subse-
quently, control is transferred back to step 200, and the
procedure is repeated, as soon as the next new image
arrives from the camera 30. In a second process, which is
5   independent from the first process, it is determined in a
step 210 whether there is enough storage space available in
the storage device 50, e.g. whether the free or non-used
storage space is above or below a predetermined threshold
value. If the result of the determination in step 210 is in
10 the affirmative, control is immediately transferred back to
the beginning of step 210. Otherwise, a step 230 is exe-
cuted, which fully corresponds to step 130 described in
connection with FIG. 2a. Subsequently, control is trans-
ferred back to the beginning of step 210, wherein an end-
15 less procedure is formed by steps 210 and 230.

In FIG. 3 the main components of the image storage
controller 40 are illustrated. An image storing module 310
is arranged to receive the sequence of new images from the
camera 30 and to store these images sequentially in the
20 storage device 50. The image storage controller 40 further
comprises an image evaluating module 320, an image selec-
ting module 330 and an image reducing module 340, all of
which are arranged to perform the operations of step 130 or
230 in FIG. 2a and 2b. The image storage controller 40 also
25 comprises a storage space detecting module 350, which is
operatively connected to the image evaluating module 320,
the image selecting module 330, the image reducing module
340 and the image storage device 50. A timezone admini-
strating module 360 is operatively connected to the image
30 evaluating module 320, the image storage device 50 and a
device 380 for user interaction. The latter may for in-
stance be a computer or any other device with input/output
means, such as a key pad, a monitor, a cursor control de-
vice, a joystick, etc.

Finally, an alarm handling module 370 is operatively connected to the alarm detector 20 and to the image evaluating module 320. Apart from the modules described above, the image storage controller 40 comprises controller means

5   for controlling the individual operation of the modules 310-370 as well as all interaction between these modules and with the camera 30, the alarm detector 20, the image storage device 50 and the user interaction device 380. The controller means may be implemented as a separate module

10   not disclosed in FIG. 3, or alternatively the functions of the controller means may be implemented by either of the modules 310-370. Furthermore, all parts of the image storage controller 40 may be realized as software routines executed on any device capable of executing computer programs.

15   Alternatively, some or all of the above modules may be implemented as various pieces of hardware, such as integrated semiconductor circuits, logical gates, discrete analog or digital components, memory components, etc.

Next, three preferred embodiments of the present in-
20   vention will be described in detail.

First embodiment

According to a first embodiment of the present invention the coverage of chronologically old (historic) video

25   image data is extended by eliminating a fraction of the images belonging to such chronologically older information, i.e. by reducing the number of frames per second (fps) for certain old video image data. The user or administrator of the surveillance system may specify a timezone table via

30   the user interaction device 380 and the timezone administrating module 360. For instance, a user-defined timezone table may look like this:

Timezone	fps	Start time (minutes)
1	25	0
2	15	60
3	2	180
4	0	1863

The timezone table above may be useful for instance if the time between guard rounds is approximately 30
5   minutes, and it is therefore preferred to have 1 h video storage at full quality, e.g. 25 fps. When the surveillance system is initially started, the image storage device 50 will be filled with video image data at full quality, i.e. 25 fps.
10   Once it has been determined in step 110 or 210, by the storage space detecting module 350, that the available storage space in the storage device 50 is below a predetermined threshold value, the image evaluating module 320, the image selecting module 330 and the image reducing module
15   340 will start processing the older portions of the video image sequence stored in the storage device 50. Assuming that the storage device 50 is capable of storing 399,960 images, and assuming that images are initially stored at maximum fps, in this case 25 fps, then the storage device
20   50 will become full just before 267 minutes of video images have been stored. At that occasion, the image evaluating module 320 accesses the timezone table managed by the timezone administrating module 360 and finds out that video image data older than 60 minutes is to be reduced to 15
25   fps. The image evaluating module 320 requests the image selecting module 330 to execute the required reduction in video quality for images older than 60 minutes. Consequently, the image selecting module 330 identifies the (25-15)/25 = 40% of the images that are older than 60 minutes

and have to be discarded. The image reducing module 340 is
called upon to execute the deletion of 10 images among the
originally 25 images within each second of video data.

5   Next, when step 110/210 again has determined, that
there is almost no storage space available in the storage
device 50, the image evaluating module 320, the image se-
lecting module 330 and the image reducing module 340 will
reduce the fps value from 15 to 2 for images older than 180
minutes. In this way, the storage device 50 will be able to
10   maintain video image data, which is as old as 1863 minutes,
as compared to 267 minutes of maximum storage time, had all
images been stored at 25 fps. Naturally, the price for
achieving such a substantial extension of the maximum stor-
age time is that the video image quality is reduced for
15   older images. However, for surveillance purposes, even a
video image quality of 2 fps will often be sufficient to
identify relevant information contained in these video
images.

       The storage schedule described above is graphically
20   illustrated in FIG. 4.

       According to the first embodiment the surveillance
performance is further improved by the provision of an
alarm settings table defined by the user and administered
by module 360. As an example, the alarm settings table may
25   be set to:

Alarm settings	fps overall during alarm	fps within alarm se-quence
Timezone 1	25	25
Timezone 2	15	25
Timezone 3	2	15
Timezone 4	0	5
Timezone 5	0	0

As appears from the above table, the surveillance system enters a second mode in response to an alarm event detected by the alarm detector 20 and reported to the alarm handling module 370. In response, the image evaluating mo-
5   dule 320, the image selecting module 330 and the image reducing module 340 are operated in a way, such that a higher fps value is used for images within an alarm sequence, which starts e.g. 5 minutes before the occurrence of the actual alarm event and ends e.g. 5 minutes after the alarm
10 event.

An exemplary course of events is illustrated in FIG. 5a-5e. An alarm event is assumed to have occurred at time T (minutes), and as a consequence the alarm mode described above has been active for 10 minutes around the alarm
15 event. The graphs in FIG. 5a-5e show the frame rate distribution at T = 0 minutes, T = 30 minutes, T = 120 minutes, T = 400 minutes and T = 2000 minutes, respectively. The 10-minute alarm sequence is indicated by a thick horizontal line. It is to be observed, that for T = 120 and T = 400
20 (FIG. 5c and 5d), the 2 fps zone ends earlier than before. In other words, in order to store the 10-minute alarm sequence with high quality, the quality of the long-term storage has been reduced by sacrificing the oldest images. In return, the system is capable of storing alarm image in-
25 formation (FIG. 5e) at 5 fps, which is much older than the 1863 minutes limit of FIG. 4.

Second embodiment
     According to a second embodiment the image storage
30 controller is arranged to operate in accordance with an adaptive algorithm, which groups the stored video image data into minutes and determines a factor of importance (weight) or qualitative value for each minute. When some of the storage space of the storage device 50 has to be re-
35 leased, the frame rate is reduced for the least valued

minute of video image data. The values of individual minutes of video data are calculated according to the following formula:

$$V_n = A_n \cdot F(T) / (T \cdot fps_n), \text{ where}$$

n is a unique identifier for each minute,

V_n is a qualitative value of minute n,

A_n is an alarm event weight of minute n,

$F(T)$ is a time-dependent discrete function, which describes the factor of importance for images of different age,

T is the age of the images, i.e. the number of minutes that have lapsed, since the images within the respective minute were created, and

fps_n is the current frame rate of the images within the respective minute.

For example, the function $F(T)$ may be set according to the following:

$$F(T) = 100 \text{ when } T<60,$$
$$90 \text{ when } 60<T<180,$$
$$80 \text{ when } 180<T<600, \text{ and}$$
$$70 \text{ when } 600<T.$$

A_n is set to 1 during normal conditions and is set to 8 during alarms and the surrounding pre/post alarm sequence of e.g. 10 minutes.

The image storage controller selects the specific minute of video data, which has the lowest weight V_n. For the selected minute of video data, the frame rate (fps) is reduced by 50%, i.e. every second frame is deleted from the selected minute of video data. Once the image quality of the selected minute of video data has been reduced in this way, the weight V_n thereof is doubled, thereby preventing the selected minute of video data from being immediately selected once more and excessively reduced in image quality.

An illustrative course of events is shown in FIG. 6a-6e. In this example the maximum storage capacity of the storage device 50 is 270,000 frames. Furthermore, when the frame rate for a certain minute has been reduced to a value below 1 fps, the entire image sequence of that minute will be removed.

Third embodiment

According to a third embodiment the image storage controller 40 is arranged to operate according to the following formula for evaluating the importance of individual images:

$V = W \cdot K_1 / (\text{current time} - \text{image creation time})$, where

V is the current value of the image,

W is the current weight of the image and depends of the status of surrounding images, and

K_1 is a factor of importance, which describes the time segment to which the image belongs. The factor of importance will be very high, if full video quality is always desired for a given time segment, and the factor of importance will be set to a low value in the least important/oldest time segment.

When an adjacent image is removed, W will be multiplied with a number greater than 1 for the two neighbouring images. The weight W is also used for increasing the importance of certain images. For instance, if an alarm event is detected by the alarm detector 20, frames belonging to a certain period of time prior to the alarm as well as after the alarm will be given a higher W. Furthermore, the user may define certain timezones of high importance. For instance, if the time between 17 p.m. and 24 p.m. is considered as high risk time, the weight W may be increased for images belonging to this period of time.

Fourth embodiment

A simple but yet effective embodiment is described below, where image quality reduction is performed for individual images rather than groups of images (such as minutes of video data).

For exemplifying reasons, a plurality of images ABCDEFGHI are stored in the storage device, wherein the images have a chronological order and image A is the oldest. Initially, all images AB...I are given the same weight 1. The weight is indicated in parenthesis below:

A(1) B(1) C(1) D(1) E(1) F(1) G(1) H(1) I(1)

Now, assuming that the image storage controller has determined a need for sacrificing one of the images, image A is selected, since A is the oldest and all images have equal weight. In response, the weight is doubled for adjacent images, i.e. image B in this case, resulting in the following situation:

B(2) C(1) D(1) E(1) F(1) G(1) H(1) I(1)

The next image to be deleted from the sequence will be C, despite the fact that image B is older. The higher weight of image B outweighs the older age thereof. When image C is deleted, the weight is doubled for adjacent images, i.e. images B and D:

B(4) D(2) E(1) F(1) G(1) H(1) I(1).

The next image to be deleted will be E, and image B will not be deleted until the age thereof outweighs the increased weight of B.

Other embodiments

As an alternative to the approaches described above, where the required image quality reduction is achieved by reducing the frame rate (fps) for certain image sequences, the image data stored in the storage device 50 may be reduced by applying any data compression algorithm know per se to the selected images or image sequences. As an

example, JPEG compression, MPEG compression, fractal compression or wavelet compression may be used. Normally, the digital images will be compressed to some extent already when they are initially stored in the storage device 50. In
5   such a case, the reduction in image quality involves increasing the compression rate and/or applying a different compression algorithm to such initially compressed images. Alternatively, the quality reduction may be achieved by discarding color information for these selected images, or
10   by reducing the size of individual images by e.g. sacrificing every second pixel within the image.

     Moreover, the initial weight or factor of importance assigned to a respective individual image may also be a function of the difference between the image in question
15   and the preceding image. If the difference is large (indicating some kind of movement in the surveillance zone 10, possibly detected by the alarm detector 20), the image in question is assigned a high initial weight; if not, a low initial weight is assigned to the image in question.
20   Advantageously, the camera 30 is connected to the image storage controller 40 and the image storage device 50 via any commercially available computer network. Hence, the camera 30 may be any commercially available network camera known per se.
25   The invention has been described above by way of a few embodiments. However, other embodiments than the ones described above are equally possible within the scope of the invention, as defined by the appended patent claims.

17

CLAIMS

1. A data storage and reduction method for digital images having a chronological order, **characterized by**
    storing a first and chronologically new image or group of images at a first image quality requiring a first amount of storage space, and
    processing a second image or group of images, chronologically older than said first image or group of images, by reducing the image quality thereof to a second image quality requiring a second amount of storage space, which is less than said first amount of storage space.

2. A method according to claim 1, wherein the processing involves deleting chronologically non-adjacent images within said second group of images, preferably for reducing a fps (frame per second) value of said second group of images.

3. A method according to claim 1, wherein the processing involves applying a data compression algorithm known per se to said second image or group of images.

4. A method according to claim 3, wherein said data compression algorithm is JPEG, MPEG, wavelet or fractal compression.

5. A method according to claim 1, wherein the processing involves discarding information relating to the color of individual pixels in said second image or group of images.

6. A method according to claim 1, wherein the processing involves discarding individual pixels in said second image or group of images.

7. A method according to any preceding claim, further **characterized** by

assigning said first image or group of images a factor of importance, which is set to a predetermined initial value,

considering said factor of importance when selecting said second image or group of images to be processed, and

increasing said factor of importance for images, which are chronologically adjacent to said second image or group of images.

8. A method according to claim 7, wherein said factor of importance is increased for images associated with an alarm event.

9. A surveillance system, comprising:

a camera;

a digital storage device; and

an image storage controller operatively connected to the camera and the storage device for receiving a plurality of images from the camera and storing the images digitally in the storage device, the images having a chronological order reflecting the points of time, at which the images were produced; **characterized** in that the image storage controller comprises:

first means for determining a qualitative value for individual images, or groups of images, stored in the storage device, the qualitative value being a function of a chronological position of the respective image or group of images;

second means for selecting, among the images stored in the storage device, a particular image or group of images in response to its qualitative value; and

third means for compressing or deleting said particu-
lar image or group of images.

10. A surveillance system according to claim 9, fur-
ther comprising fourth means for determining an amount of
storage space available in the storage device and for acti-
vating said first, second and third means, if the storage
space is below a predetermined value.

11. A surveillance system according to claim 9 or 10,
further comprising fifth means for maintaining a timezone
table, in which the images stored in the storage device are
divided into different timezones depending on the chrono-
logical positions of the images, the first means being ope-
ratively connected to the fifth means and being arranged to
determine the qualitative value of each image in response
to its timezone.

12. A surveillance system according to any of claims
9-11, further comprising sixth means, operatively connected
to the fifth means, for allowing a user to define or re-
define the timezone table.

13. A surveillance system according to any of claims
9-12, further comprising seventh means responsive to an ex-
ternal alarm signal and arranged to supply an alarm event
to the first means in response to the alarm signal, the
first means being arranged to consider the alarm event when
determining the qualitative values, preferably by locally
increasing the qualitative values for images within a time
interval chronologically close to the alarm event.

14. A surveillance system according to any of claims
9-13, wherein the first, second and third means are
arranged to select and delete chronologically non-adjacent

images at regular intervals within a subset of the images in the storage device, preferably so that a frame per second (fps) value is reduced for said subset.
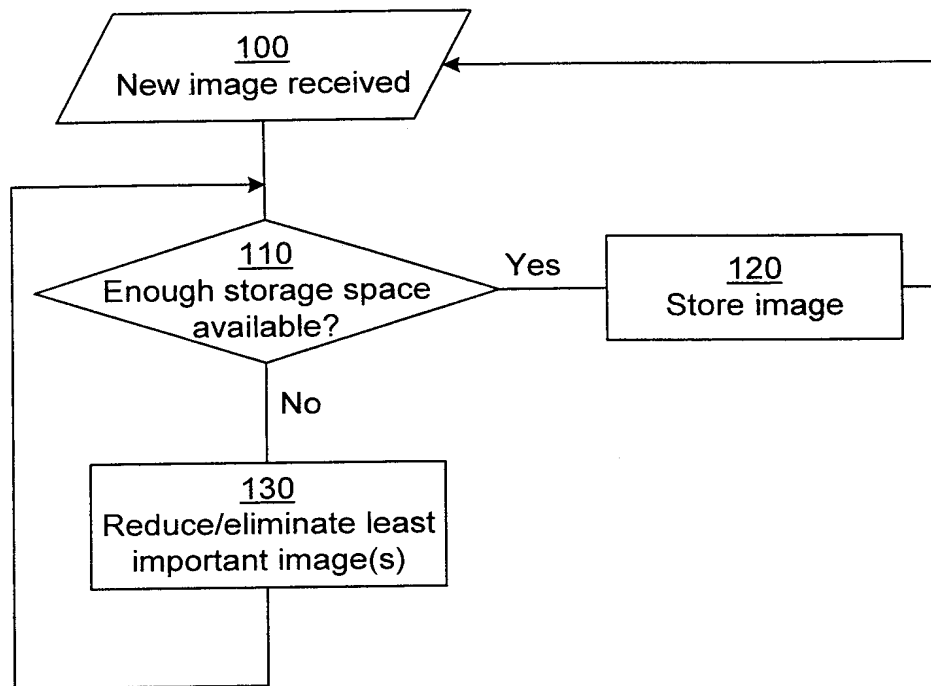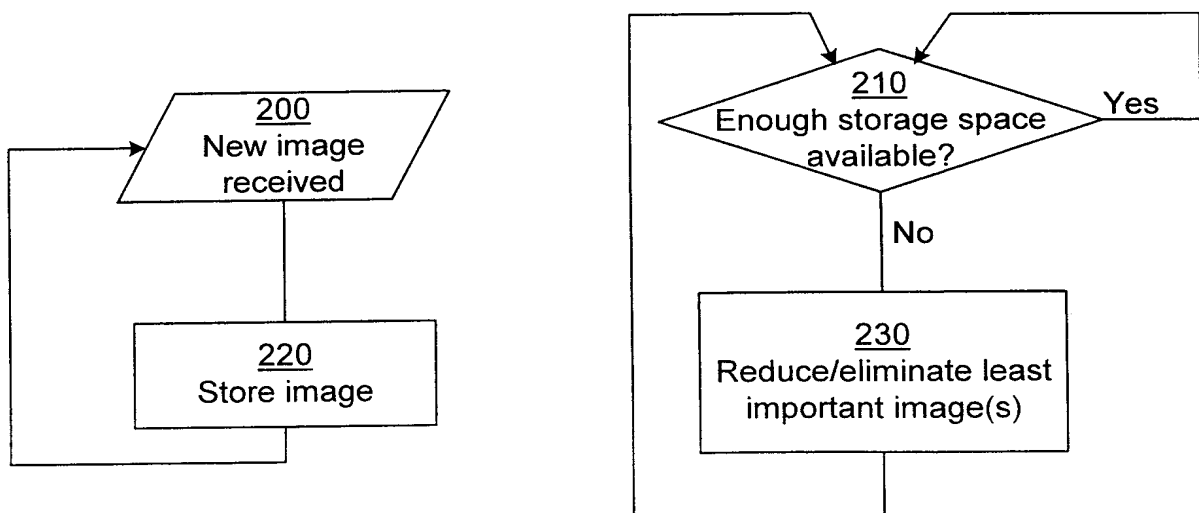
1/9
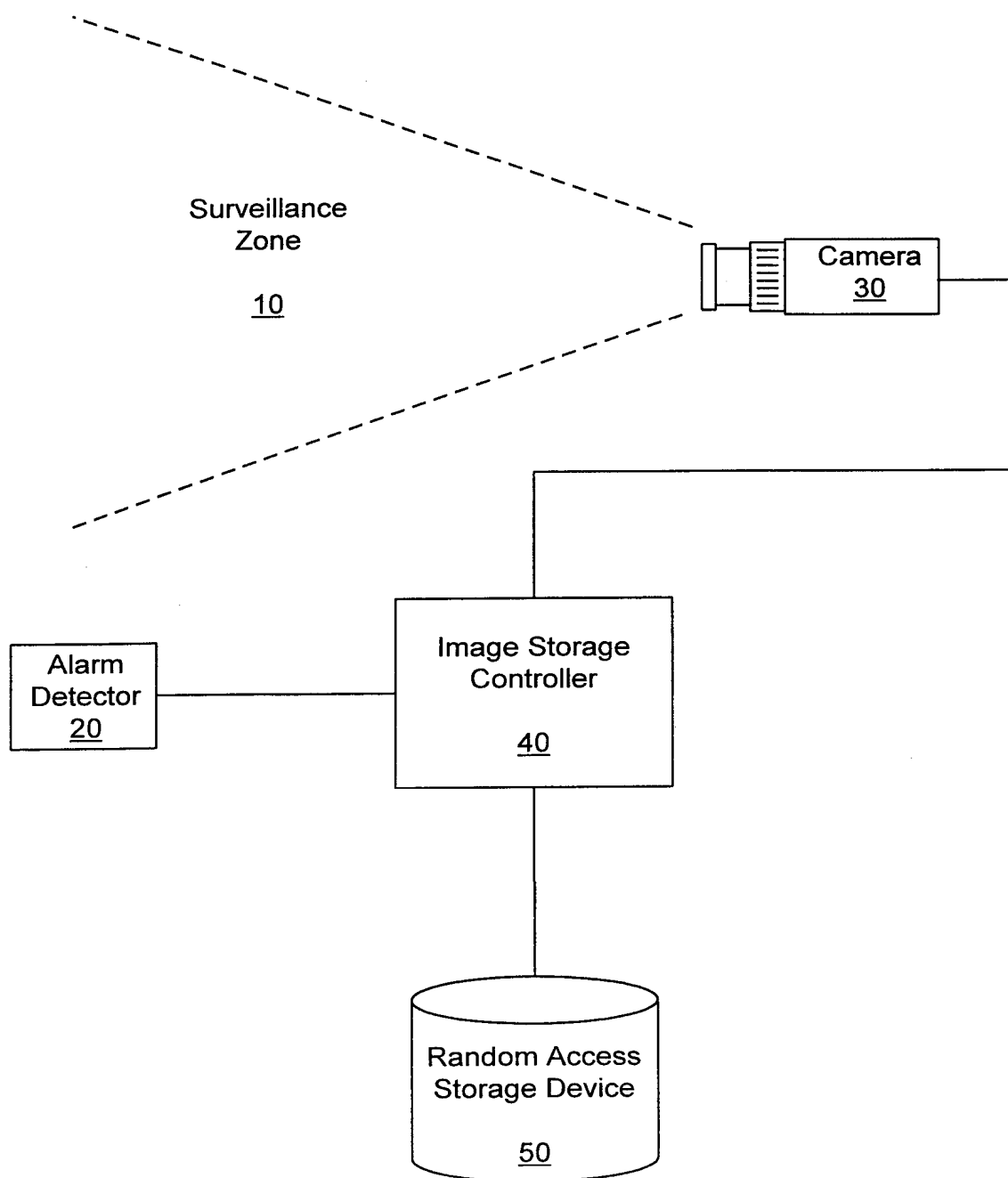
Surveillance
Zone

10

Camera
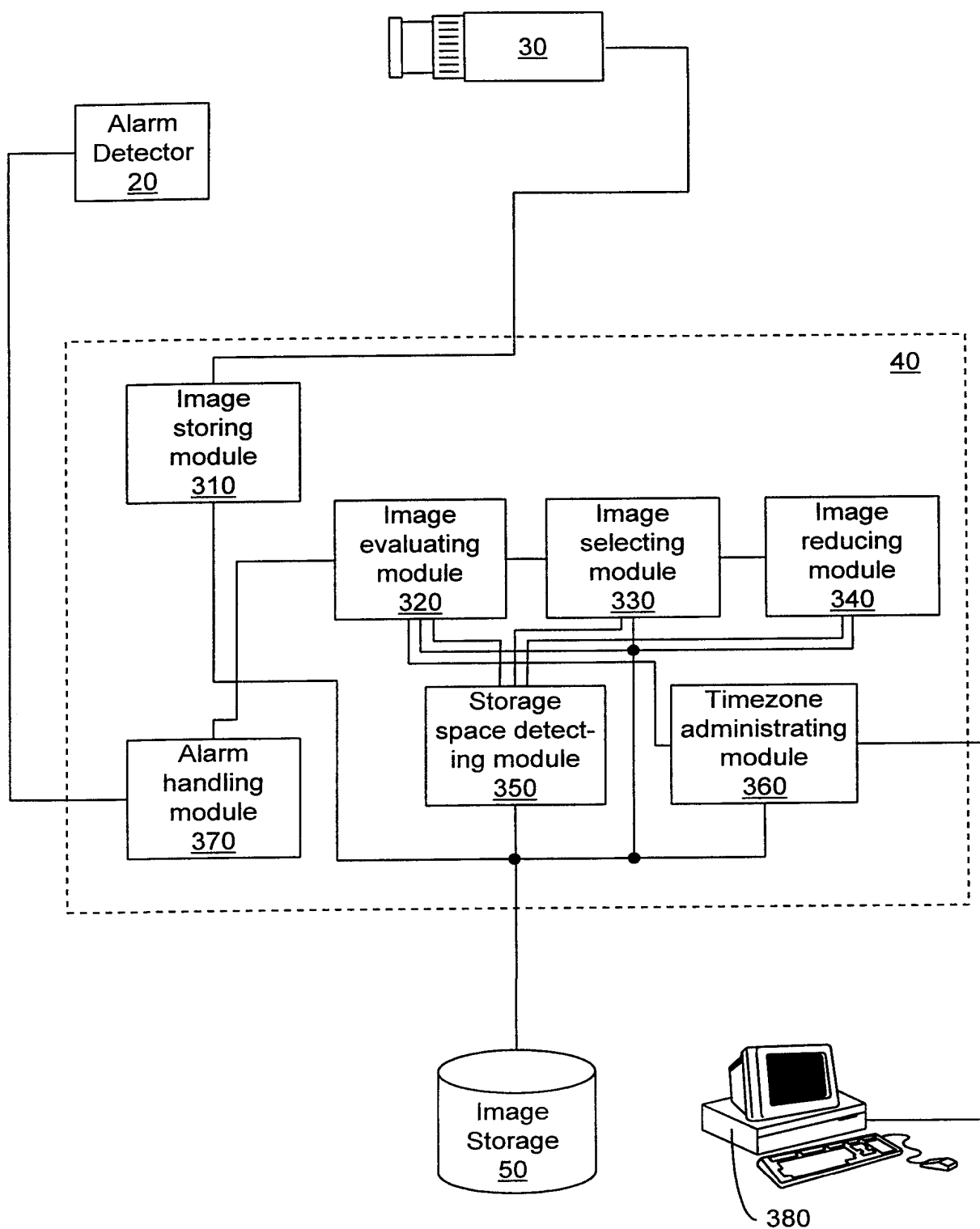30
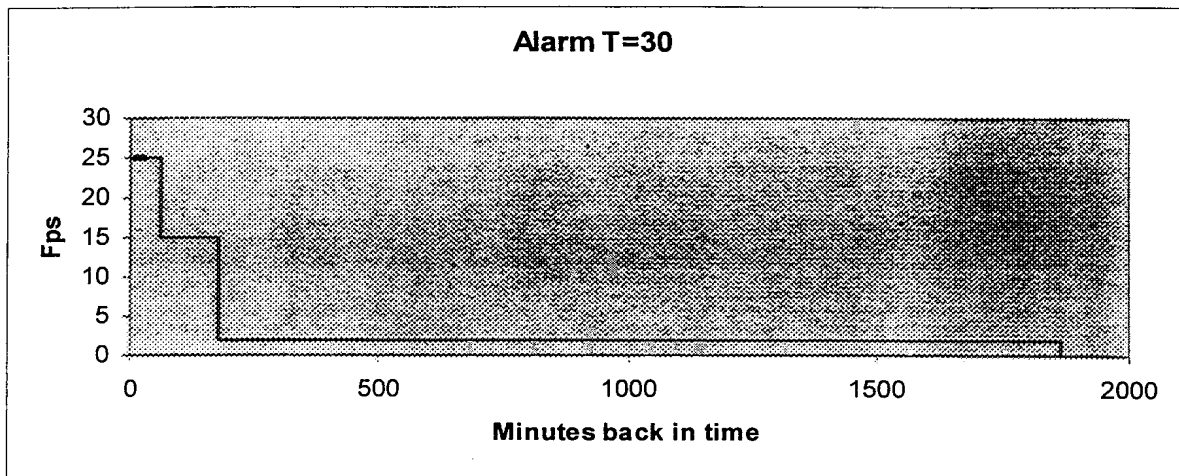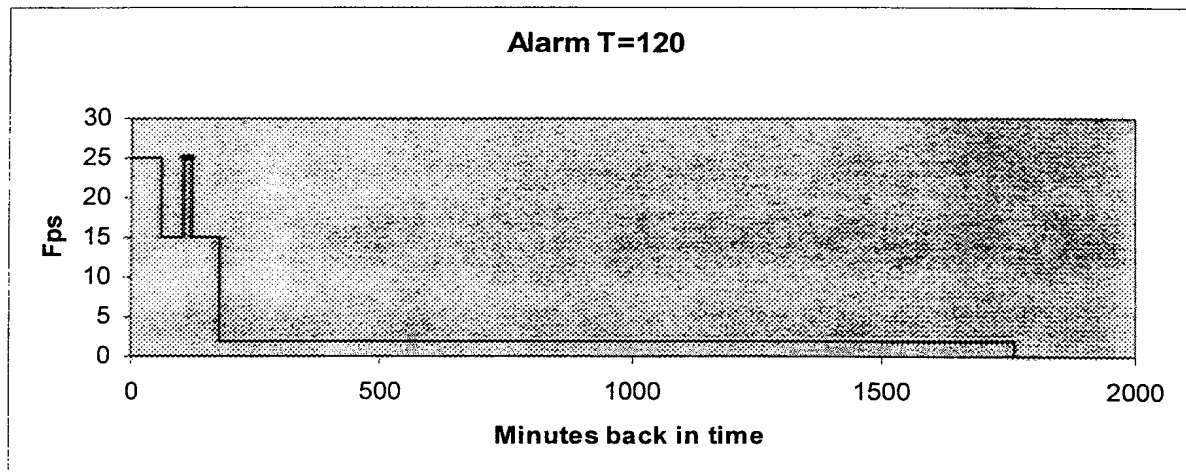
Alarm
Detector
20

Image Storage
Controller

40

Random Access
Storage Device

50

FIG 1

FIG 2a

FIG 2b

FIG 3
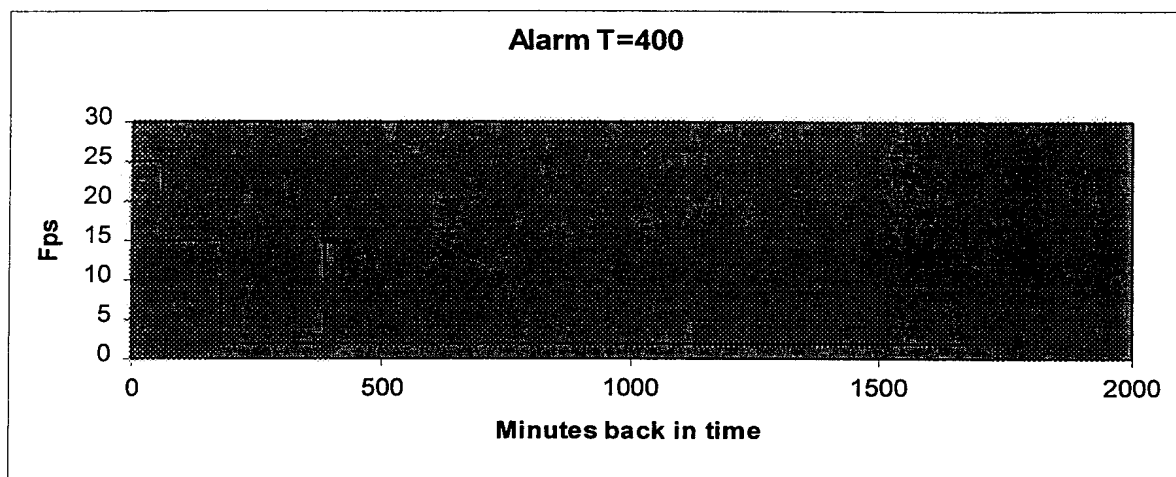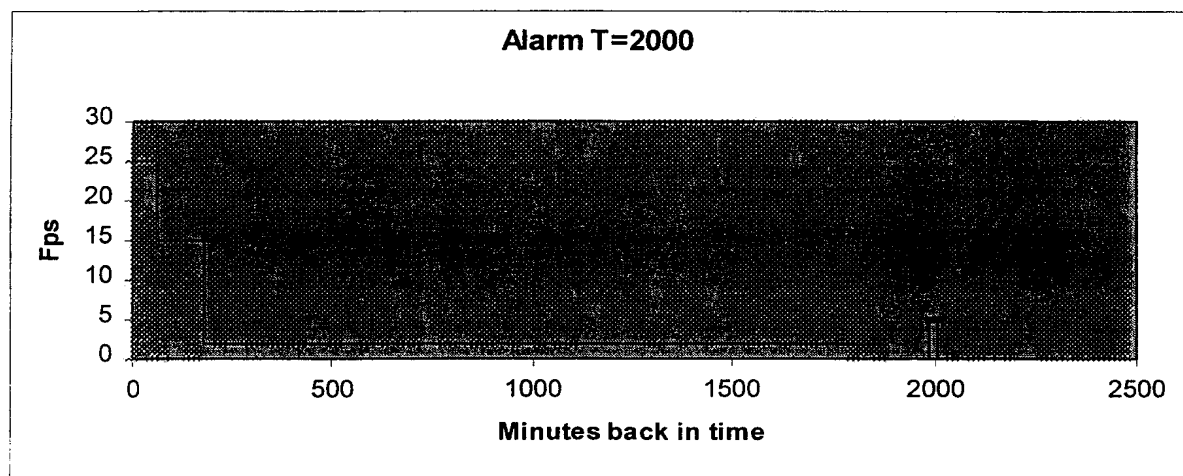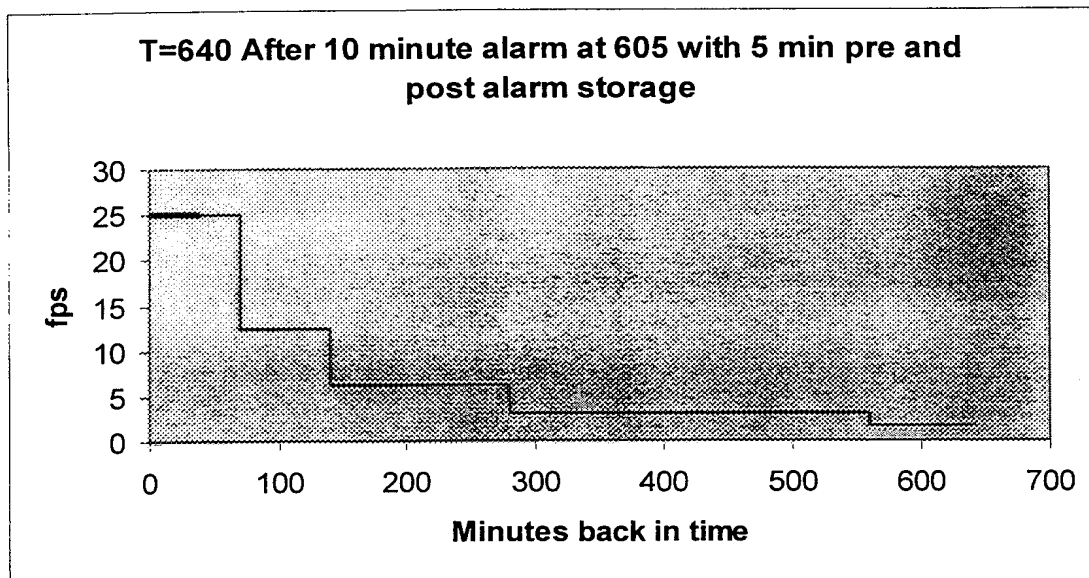
FIG 4

FIG 5a

FIG 5b

FIG 5c

FIG 5d

FIG 5e

T=640 After 10 minute alarm at 605 with 5 min pre and post alarm storage

FIG 6a

T=1000 After 10 minute alarm at 605 with 5 min pre and post alarm storage
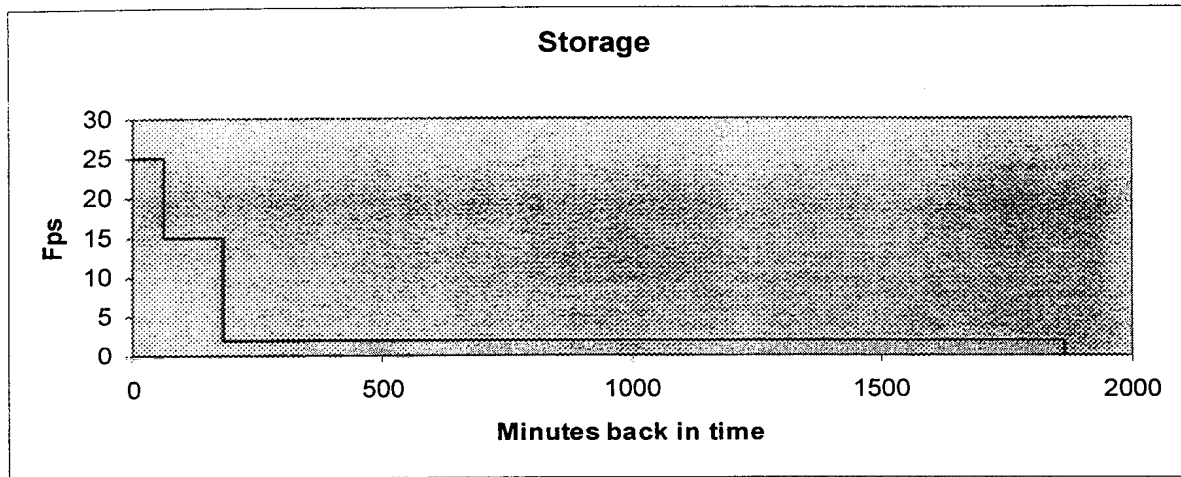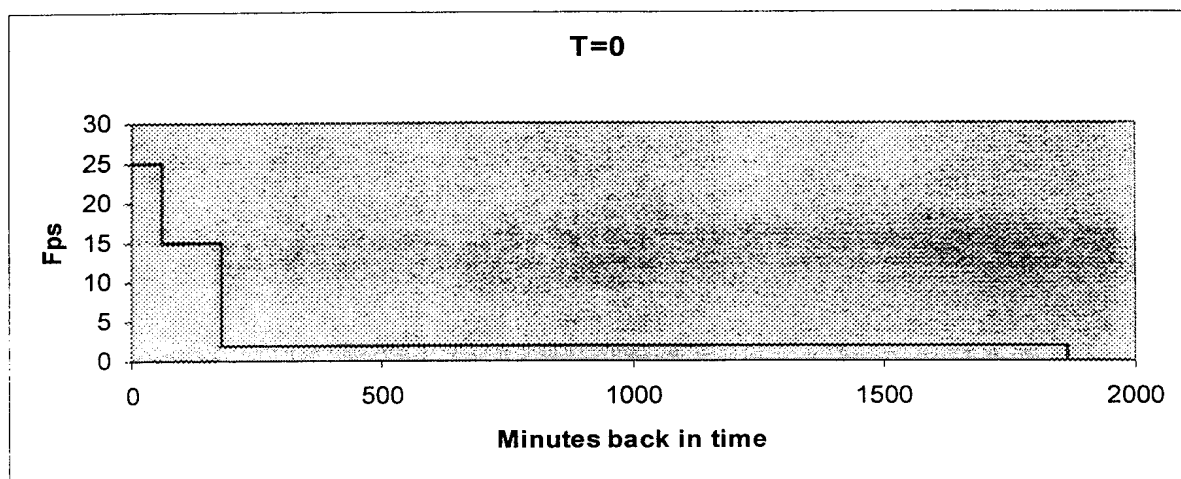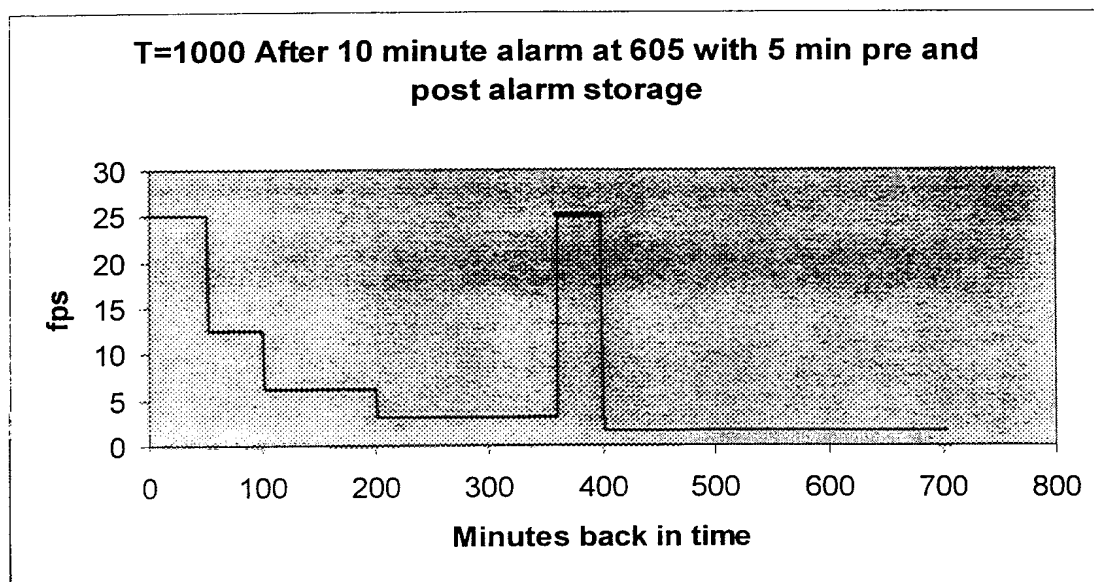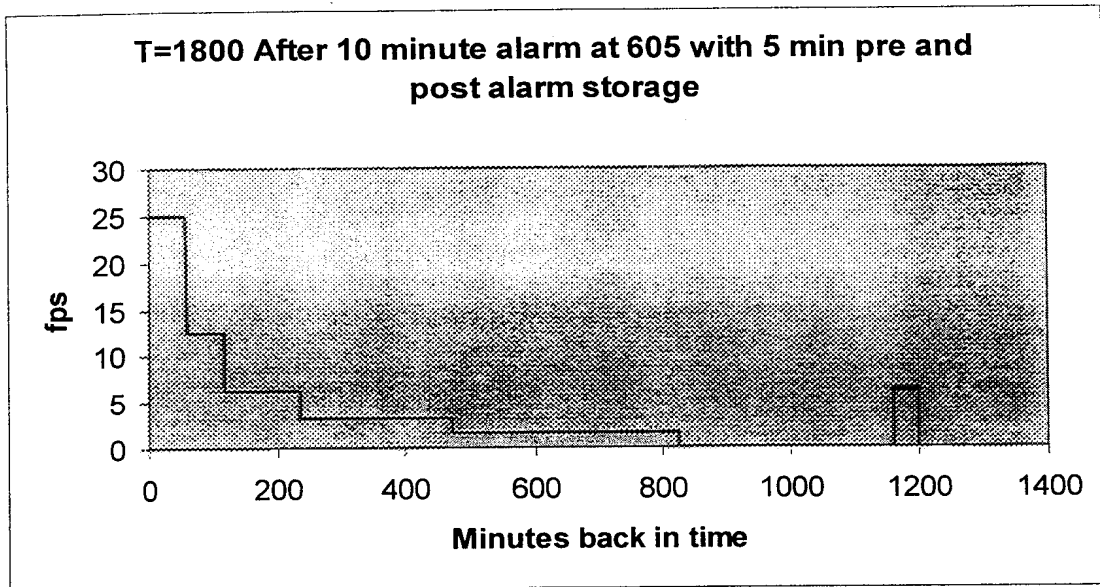
FIG 6b
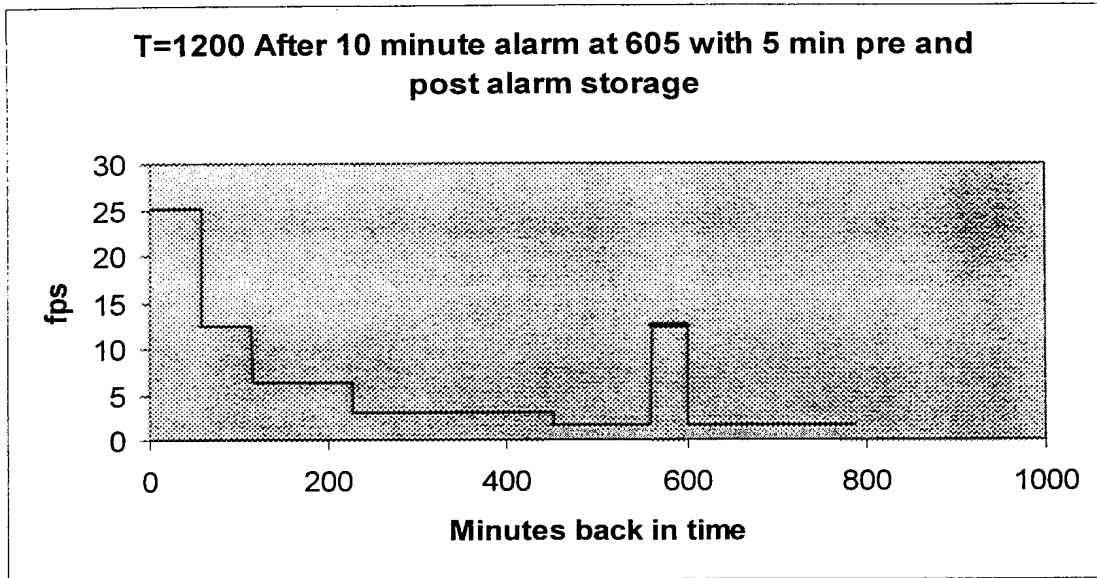
FIG 6c
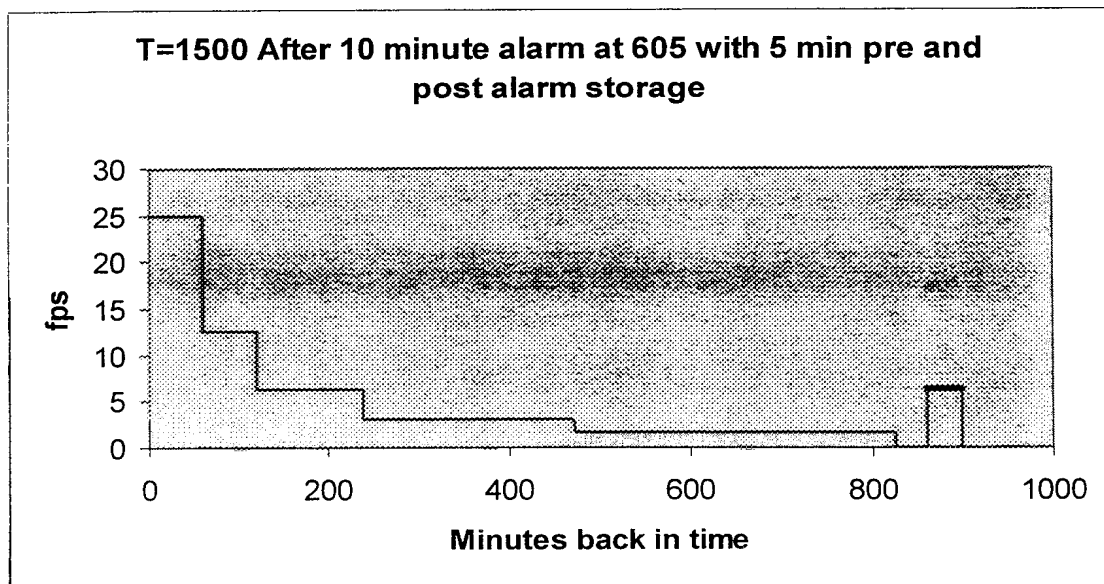
FIG 6d

FIG 6e

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/00161

A. CLASSIFICATION OF SUBJECT MATTER
IPC7: G06F 17/30, G08B 13/196, H04N 7/18 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC7: G06F, G08B, H04N
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
SE,DK,FI,NO classes as above
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5724475 A (JEFF P. KIRSTEN), 3 March 1998 (03.03.98), column 2, line 63 - column 5, line 17, figure 2	1,3-6
Y		2,9,10
A		7,8,11-14
	--	
Y	US 5072296 A (JAE S. LIM), 10 December 1991 (10.12.91), column 1, line 22 - line 24	2
	--	
P,Y	Patent Abstracts of Japan, abstract of JP 11-168685 A (SONY CORP), 22 June 1999 (22.06.99)	9,10
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☐ Further documents are listed in the continuation of Box C.   ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 May 2000	1 8 -05- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Oskar Pihlgren/mj Telephone No. + 46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5724475 A	03/03/98	NONE		
US 5072296 A	10/12/91	AU	7335791 A	18/09/91
		WO	9113520 A	05/09/91